EXHIBIT 1

P12553

Referee's Recommendation		For Legal Operation Use
Name:	Date:	Docket Number: EUS04298-RMOT
Check Recommendation: ☐ File: Disclosure Complete ☐ File: Prepare Full Disclosure ☐ Publish in TDB	☐ Do Not File (Specify Reasons) ☒ Review Further ☒ Keep as Formal Trade Secret	Date Opened: 2000-08-07 TMC/BC
Referee's Comments:		

OIPE
SEP 2 7 2004
PATENT & TRADEMARK OFFICE

RECEIVED
SEP 3 0 2004
Technology Center 2600

Ericsson Inc. Invention Disclosure Cover Form

1. **Invention Title:** Method To Improve Performance Of A Gps-Equipped Radiotelephone By Peer Aiding

2. **Disclosure Submitted by (Add additional sheets if more than three inventors):**

	Inventor No. 1	Inventor No. 2	Inventor No. 3
(a) Full Name	L. Scott Bloebaum	Havish Koorapaty	
(b) Home Address	103 Battery Point Place Cary, NC 27513	102 Horsepond Ct. Cary, NC 27513	
(c) Work Phone	919-472-7243	919-472-7524	
(d) Citizenship	U.S.	India	
(e) 5-Digit Pay No.	24784	23662	
(f) Manager	Seung Kim	Ali Khayrallah	
(g) Bus. Unit	RMOT	RCUR	
(h) Cost Center	13141	11101	

3. **Date invention conceived (mm/dd/yy):** 7/17/00

4. **Date invention reduced to practice:**

5. **Identify (including dates) any past or anticipated disclosure outside the company, such as publication, offer for sale, actual sale, discussions with business partners, etc.:**

6. **Invention made using government or non-Ericsson funding?:** No

7. **Present or proposed use of the invention (identify products and dates):**

8. **Identify related invention disclosures of which you are aware:**

9. **Please attach to this cover form your invention disclosure, along with any other relevant documentation (see "IPR at RTP" Web site for additional information on writing disclosures).**

The invention described in the attached invention disclosure is hereby submitted under my employment agreement with Ericsson Inc.

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

RECEIVED
AUG - 7 2000
Patent Engineering

Inventor: Submit to Kristen DeSimone, Davis-2B, Cubicle #2421, x7711.

Revision: 02/04/99

Prepared		Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty		August 2, 2000	A	EUS04298
Approved	Checked			File

Method to Improve Performance of a GPS-Equipped Radiotelephone by Peer Aiding

Scott Bloebaum and Havish Koorapaty

1. What problem is solved by your invention? Describe generally the nature of your invention and what area of technology it addresses.

This invention falls in the general category of integration of geo-location capabilities into a mobile radiotelephone or other wireless device that communicates with a radio network. In particular, this invention relates to improving the performance of location-capable radiotelephones by utilizing aiding information. This improvement can be in terms of time required to obtain a position, or the sensitivity of the location receiver in adverse signal conditions. The novelty of the current invention is that the aiding is done by peer devices rather than some central node within or outside of a radio network. Thus, this invention proposes a client-server architecture where user devices may play the roles of client or server depending on the amount of information they have or need at any given time.

Why do we need pos. info?

2. How was this problem solved before (inside or outside Ericsson)? Cite any known inventions for which yours is a replacement.

There are many solutions that address of the problem of aiding information to a positioning receiver via the communication capabilities of a mobile radiotelephone (subsequently referred to as MS). Generally, these methods are related to aiding a Global Positioning System (GPS) receiver. U.S. Patent 5365450 describes one previous solution for the mobile-based category. In this approach, the network transmits GPS satellite ephemeris and other information to the MS, which then utilizes this information to acquire the GPS satellite signals and to compute a position estimate. Other methods are described in U.S. Patents 5418538 and 5883594, as well as Ericsson U.S. patent applications 09/063028 and 60/096436, among others.

Prior art for other disclosure?

3. What were the shortcomings of those earlier solutions? Explain why the known inventions are insufficient. What was the motivation for your invention?

The main principle of the previous approaches was that they relied on a centralized, fixed server that collected GPS information and distributed it to remote mobile devices either on a broadcast or per-request basis. This is the classic client-server architecture, with the positioning-capable MS always behaving as

Prior art

How is GPS info collected at central pt.? (location dependent)

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1)	
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

975687

Prepared		Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty		August 2, 2000	A	EUS04298
Approved	Checked			File

the client in the transaction. In this invention, however, the mobile devices themselves can behave as servers to other mobile devices, satisfying requests from other peer mobile devices for aiding information. Combining this flexible architecture with fully network-independent position capability in the mobile devices opens the door to a wide range of new possibilities for location-sensitive applications between peer devices that are members of a "community."

4. **What is your invention and how is it better than those prior solutions? Describe in detail the structure and operation of your invention, including the features which make it advantageous over known inventions. Be specific in your description of how to make and use your invention. Attach drawings, flow charts, block diagrams, schematics, etc.**

Start here

Figure 1~~Figure 1~~ below shows a radio network comprised of a core network (CN) and a radio access network (RAN), identified as a plurality of radio base stations (BS) each of which serves a region or cell in the network. An example of such a network is the cellular telephone network, including commercially operational ones based on well known industry standards such as GSM, TDMA or CDMA. The core network consists of the interconnections between the plurality of BS and also interconnection with external networks, such as the PSTN and Internet.

Also shown in Figure 1~~Figure 1~~ is a plurality of positioning-capable mobile radiotelephones that access the radio network. The following description uses GPS as an example positioning technology, denoting the positioning-capable radiotelephone (or MS) as *GPS-MS* such as in Figure 1~~Figure 1~~. However, this is not intended to limit the invention to GPS receivers. Other positioning technologies such as Russian GLONASS are also relevant. As shown in the figure, the GPS-MS receives signals from the positioning signal sources (e.g., satellites) and has a bi-directional radio link with one or more of the plurality of BS.

The lower layers of the communication protocol between the BS and the MS tends to be relatively generic for most air-interface standards, providing a foundation for developing applications that are interesting to the user of the wireless device. Such applications include email, web browsing, etc. Another class of applications that are becoming increasingly important to users is group information services, where multiple members of a group share information about their activities, plans, etc. A wide variety of groups can be imagined, including families, work teams, and friends.

One particularly interesting type of group application is requesting and sharing of position information among some or all members of a group. The provision of position information allows group members to locate each other in order to meet for dinner, sporting activities, shopping, etc. Having GPS capabilities in the MS allow the user to respond to requests with a highly accurate position. However, it is well-known that autonomous GPS does not work in all environments and all situations, due to low signal strength from the satellites. Thus, there may be many times where the GPS-MS user cannot send his

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

Prepared	Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty	August 2, 2000	A	EUS04298
Approved / Checked			File

current position because he is unable to receive a sufficient number of GPS signals to compute it. Given the proper aiding information, however, the GPS-MS can improve both sensitivity and time-to-first-fix.

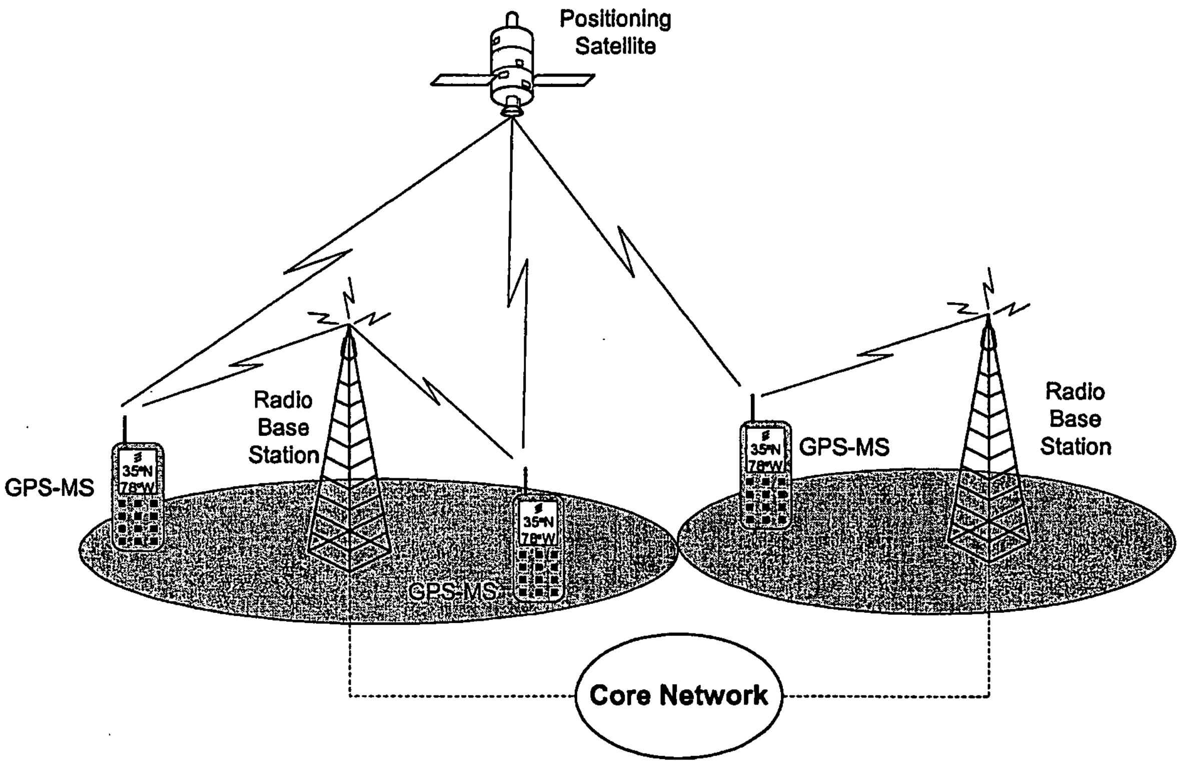

Figure 1.

A key aspect of the current invention is that rather than getting aiding information (assistance) from some central source or server within or outside of the CN, the GPS-MS can request and receive assistance from other GPS-MS within the group or community. Consider the example shown in Figure 1~~Figure 1~~ above. The three GPS-MS are within geographic proximity, either within the same or a nearby cell. One of the GPS-MS is in a favorable signal environment (e.g., outdoors) where it is able to acquire a plurality of the visible satellite signals, demodulate navigation message (ephemeris, etc.) and store this data in memory. Alternately, the first GPS-MS could retrieve aiding information from a source (i.e., server) within or outside of the CN. In either case, the first GPS-MS has the necessary information to compute its own position, and stores this information for future usage.

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

Prepared		Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty		August 2, 2000	A	EUS04298
Approved	Checked			File

① Subsequently, a second GPS-MS in the vicinity of the first GPS-MS needs to determine its own location, and also perhaps the location of the first ~~GPS-MS for some group-wise~~ application. The second GPS-MS sends a query to the first GPS-MS requesting assistance in determining its own position, and the first GPS-MS may respond with one or more of the following according to its internal information:

- List of visible satellites and corresponding ephemeris and clock corrections;
- Approximate GPS time-of-week (TOW);
- Approximate position, e.g., current or last position computed;
- Ionospheric or differential corrections;
- Satellite almanac.

② Another aspect of the invention is that the second GPS-MS may choose not to provide the aiding information to the requesting GPS-MS. The GPS-MS user has control over the privacy of both his position and aiding information, either globally or for particular user(s) within the group.

③ In another aspect of the invention, the second GPS-MS may send out a request for aiding to all members of the group rather than to only the first GPS-MS.

The main contributions of the disclosure are summarized in the points below, which could serve as a structure for the claims in the application:

Mobile Server

1. **Server-client duality of an MS:** The concept of a server in a cellular network is typically constrained to have the server as a fixed node within the cellular infrastructure. An aspect of this invention is an MS that is allowed to be a server in addition to being a client in the cellular network, where it provides information to other mobile terminals in the network. An example of this is an MS with a GPS receiver that is capable of providing GPS assistance data such as almanac, ephemeris, reference time, reference location and ionospheric corrections to other MSs in the cellular network and to fixed nodes within the cellular and backbone networks. The key idea here is that the server is not necessarily a fixed node but is mobile.

Direct MS⇔MS comm?

2. **Exchange of information between a set of MSs in the cellular network**: Cellular networks currently are set up such that MSs in the network exchange information and interact mainly with the base station except for user initiated interaction between MSs, such as mobile-to-mobile voice calls or SMS messages. This invention proposes a mode of operation for a cellular network where information is exchanged via MS to MS interaction in situations that are not initiated by the user of each MS in real time. Examples of the use of this feature are as follows:

   Multiple MSs may exchange position information or aiding information facilitating or enhancing position computation. Such information could be the computed positions of the MSs or it could be specific pieces of assistance data useful for enhancing GPS receiver performance. The pieces of assistance data could be approximate time, reference (approximate) location, visible satellites,

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

Prepared		Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty		August 2, 2000	A	EUS04298
Approved	Checked			File

almanac, ephemeris, ionospheric corrections, etc. Such information could also be location of nearby base stations that is computed by certain MSs with GPS receivers and shared with other MSs that may not have GPS receivers but that may compute their positions using the cellular network with the knowledge of the base stations locations. This is particularly useful in networks that have synchronized base stations such as EDGE compact. Alternately, in systems where the base station locations are transmitted by the system or are otherwise known, but the timing of their transmissions is unknown, MSs with GPS receivers can compute the transmission times from different base stations and share this information with MSs which do not have GPS receivers so that these MSs may compute their positions from signals in the terrestrial system. The MSs with GPS receivers can compute base station transmission times if the base station locations and the location of the MS itself is known. Similarly, they can compute the base station locations if the base station transmission times are known but the locations are not.

It should be noted that in general an MS may compile the information that it needs from multiple sources in the group. Hence, the MS can put together data about different satellites from multiple group members. The MS may need to sort the compiled data based on some criterion such as age of the assistance data.

part of Invention ?

Exchanges of information such as phone numbers and email addresses between phones may take place. Such exchanges may be generated, for example, by a high level requirement by a user for synchronization between the data bases of multiple phones used by the user. Alternately, such applications may be attractive to a group of users who wish to share common information data bases and keep them synchronized and updated.

? ?

- **Bearers for communication between mobile terminals:** MSs within the network may communicate using SMS. The MSs may also communicate through the WAP protocol or purely using IP. In essence, any form by which a mobile can send messages to another mobile terminal may be used for exchanging information.

Known ?

3. **Establishing MS groups for specific information sharing purposes**: Groups of MSs may be formed in an ad-hoc manner in order to share specific information.

- **User initiated group formation:** For example, all the members of a family may choose to form a group that shares GPS assistance data in order to improve GPS receiver performance. Similarly, a set of friends could form a group in order to share files for applications such as games or music between their MSs. In these cases, the MS joins a group through direct initiation by the user of the MS.

- **Group formation without user initiation based on profiles set up by the user:** A user may set up a profile within the phone for the class of requests the MS may entertain and the services for which the MS may join groups. The profile may also indicate that an MS should join a group for a certain type of information sharing service if it can find such a group. After the profile is set up,

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

Prepared		Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty		August 2, 2000	A	EUS04298
Approved	Checked			File

whenever the MS is in contact with another MS either for a voice call or for messaging, the MSs may exchange information regarding the type of information service groups they can be part of and would like to be part of. If the other MS is part of or has knowledge of such groups, then the MS may join the group. Similarly, the MS may allow the other MS in the messaging or voice transaction to join a particular group. An example of such an ad-hoc group might be a group that has access to a particular set of games. The user of the MS may determine that he would like the MS to be a part of a group that can share a particular class of games. The classification of games may be determined by the common application used by all the MSs in the group.

Master must be present when new member joins?

i) **Master and slaves for group management**: In order to facilitate decisions on whether an MS may join a particular group and to maintain a list of the members of the group, one MS may serve as the master for the group by storing this information and making sure MSs that are admitted into the group satisfy all the privacy and any other constraints that might be set up.

ii) **Fixed node in the network for group and service management**: In another embodiment, the formation of groups and the maintenance of a list of MSs within each group may be performed by a server that is located within the cellular or the backbone data network. For example, the server could be located within the backbone IP network and be accessible via IP or WAP protocols. Such a server can be used to allow an MS to query the information services available and also to query some or all group members within a certain area. The server may also be used to maintain the status of MSs within a group with reduced traffic. For example, such a server may maintain the set of MSs that are able and willing to provide GPS assistance data at the current time.

accessed over cell network ?

- **Forming hierarchical groups (sub-groups) based on priorities**: Sub-groups may be formed within groups and sub-groups and priorities may be assigned to the members of each group or sub-group. These priorities may indicate the preferences for requesting information. For example, when an MS needs GPS assistance data, it might query members of the sub-group with the highest priority for this function. If it does not obtain information from any of the MSs in this sub-group, it will then query MSs belong to lower priority sub-groups. Note that sub-groups may be formed independently for each information sharing function. Therefore, there may be different sets of sub-groups defined for sharing GPS assistance data information and for sharing game application files with no dependence between these two sets of sub-groups.
- **Query of capabilities**: A protocol may be set up that allows MSs within the cellular network to query each other about specific information sharing capabilities, such as the capability to gather and distribute GPS assistance data.
- **Determination of trust for information received.** Although the traditional fixed client-server relationship relies on the principle that the data from the server is valid, this principle is not

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

Prepared	Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty	August 2, 2000	A	EUS04298
Approved / Checked			File

necessarily true for the peer-aided case. When the user receives aiding information from some other member of a group acting as a server, the user must determine the validity of that information, based on the trustworthiness of the source. In the case of GPS assistance, for example, it is possible for a server to spoof the requesting GPS-MS by sending false or inaccurate orbital information for the GPS satellites, which could lead to erroneous position results in the client GPS-MS. To address this problem, the client application could assign levels of trust to different groups, e.g., inner circle (family), outer circle (friends and associates), world (everyone else), and decide from which ones to accept assistance. The client application then matches the available sources with these groups to determine:

i) If a source is available that meets the client criteria for trustworthiness, and if not, whether or not to get the information from a secure fixed server instead.

ii) If multiple sources are available, which ones are the most trusted.

Note that the user of the GPS-MS could set the "trust" parameter by a choosing from a menu, with a default trust requirement assumed prior to any choice made.

4. **Coordinated information sharing between the members of a group for the benefit of all the members of the group**: The techniques for this part of the invention, explained in the context of GPS assistance data, are as follows:

- **Regularly scheduled gathering of GPS assistance data**: MSs in a group that shares GPS assistance data may decide to share GPS information such as almanac, ephemeris and reference time information periodically with the MS providing the information to the group being different each time. For example, ephemeris information is valid only for 2-4 hour periods. Let us say that the four members of a family located in the same city decide to form a group for sharing GPS assistance information. Each MS in the group may be scheduled to obtain ephemeris information directly from the GPS satellites (in areas without any network assistance for GPS) once every 8 hours. The scheduled times for the four MSs in the groups are staggered such that one of the four MSs is obtaining ephemeris data every 2 hours and distributing this data to peers in the group. Thus, all the MSs in the group have up to date ephemeris data through cheap messaging operations that require receiver on times of less than a second except when it is the turn of an MS to obtain the ephemeris data directly from satellites which may take more than 12 seconds. This technique enhances the GPS receiver performance of all phones in terms of time to first fix with a significant reduction in the associated penalty of maintaining up-to-date ephemeris by reading them off the satellites.

- **Supply of GPS assistance data by an MS within a group to other MSs in the group to enhance their GPS receiver performance**: When MSs are part of a group that shares GPS assistance data information in an area where GPS assistance data from the cellular network is unavailable, an MS that has poor signal-to-noise ratio for acquiring signals from the GPS

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

Prepared		Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty		August 2, 2000	A	EUS04298
Approved	Checked			File

satellites may probe other MSs within the group for assistance data. This is a likely scenario for an MS that is in an indoor environment and is required to compute its own position. Any of the MSs within the group that have good signal-to-noise ratio for the GPS satellite signals may then obtain the assistance data and pass the data on to the MS requiring it via the cellular infrastructure. The assistance data will then significantly enhance the sensitivity and time to first fix of the GPS receiver in the MS required to position itself.

Comm w/ other MSs through cell network?

In another embodiment, when MSs are part of a group that shares GPS assistance data information in an area where GPS assistance data from the cellular network is available, an MS that travels to an area without network assistance can obtain assistance from other MSs in the group that are within the home area (with network assistance) for GPS assistance data. One of the MSs within the group will then obtain the assistance data from the network and provide the assistance data to the MS that is travelling. In order to account for the difference in visible satellites, the MS requesting the assistance data may provide a superset of satellites that contains is guaranteed to have the visible satellites as a subset. Some forms of assistance such as reference time (GPS time with respect to a local base station's frame timing) clearly cannot be provided in this embodiment. However, ephemeris and almanc information can be provided.

- **Supply of GPS assistance data by an MS within a group to other MSs in the group for other reasons such as cost reduction:** This technique allows users to share GPS information to avoid network access charges, etc. One could get it from a network server and then pass around to all others in the group. One key difference, however, is that GPS information is public-domain.

So what?

5. **Downloading information sharing applications and launching them from a browser:** Applications for various information sharing services may be downloaded from a web site on the data network. For example, a GPS assistance sharing application could be downloaded from a portal or a web site. Such an application may also be set up as a plug-in for the browser in the MS so that gathering of assistance data for the GPS receiver from peer groups may be launched from the browser.

6. **Constraints for participation in group information sharing activities that ensure minimum performance level and privacy of the MS:** The user of the MS may set up a profile that selects from one of several levels of desired standby time and talk time performance. These levels may be indicated as a percentage of the maximum standby and talk time offered by the phone. Such a profile may then be used by the information sharing application to determine to what degree the MS will participate in the group sharing activities. For example, a particular standby time limit may cause the MS to admit requests for GPS assistance information with only a certain maximum frequency such as one request every 30 minutes. The highest priority class among the priority classes discussed earlier may be set up to overide such constraints. Constraints may also be set up to protect the privacy of the MS. Hence, an MS may not provide its position information to members of a group if its privacy constraints are not met by the MS to which the information is being sent.

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	

Prepared		Date	Rev	EUS no. (For Patent Engineering Use Only)
RT/EUS Scott Bloebaum, Havish Koorapaty		August 2, 2000	A	EUS04298
Approved	Checked			File

7. **Exchange of information during mobile to mobile voice or data calls:** MSs that are currently engaged in a voice call may exchange information such as GPS assistance data if an MS requires such data and the other MS has the data, if privacy conditions and the performance constraints discussed above are met.

L

Stop

Inventor's Full Signature	Date	Witnessed, read, understood and signed by	Date
(1) [signature]	Aug 4, 2000	(1) [signature]	8-4-2000
(2) [signature]	Aug 4, 2000	(2)	
(3)		(3)	